

A following association between juvenile *Epinephelus marginatus* (Serranidae) and *Myrichthys ocellatus* (Ophichthidae)

by

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RÉSUMÉ. - Une association entre un mérou noir juvénile *Epinephelus marginatus* (Serranidae) et *Myrichthys ocellatus* (Ophichthidae).

Les informations sur le comportement des poissons marins du Brésil sont très réduites. Nous présentons dans ce travail la première observation d'une interaction dans laquelle un mérou noir *Epinephelus marginatus* (Lowe, 1834) agit comme suiveur d'un *Myrichthys ocellatus* (Lesueur, 1825). Ce comportement a été observé par hasard dans un récif de la Réserve marine biologique de Arvoredo, située sur la côte centrale de l'état de Santa Catarina, Brésil. Bien que l'observation ait été unique, l'interaction entre ces deux espèces nous a semblé apporter un bénéfice pour le mérou suiveur, qui peut ainsi chasser des proies cachées. Nous l'avons vu défendre activement sa place auprès de *M. ocellatus*, contre l'approche de deux autres jeunes mérours.

Key words. - Serranidae - *Epinephelus marginatus* - Ophichthidae - *Myrichthys ocellatus* - ASW - Arvoredo Biological Marine Reserve - Brazil - Interspecific foraging association - Agonistic behaviour - Following behaviour.

Interspecific foraging associations have been thought to bring benefits to individuals as they might increase feeding success by making normally inaccessible food resources available and/or decrease in susceptibility to predation (Dubin, 1982; Diamant and Shpigel, 1985; Gibran, 2002; Soares and Barreiros, 2003). Following behaviour makes possible to opportunistic or generalist fish (followers) to feed on prey items which are not targeted by the nuclear species. These associations have been reported for a variety of vertebrate taxa (see Strand, 1988, and references therein), and apparently do not affect negatively the nuclear species (Karplus, 1978; Dubin, 1982; Diamant and Shpigel, 1985; Soares and Barreiros, 2003).

Grouper lay amongst the most inquisitive fishes. This characteristic is well documented on several studies where their opportunistic and learning behaviour turns out into feeding tactics such as following octopuses, moray and snake eels (Karplus, 1978; Diamant and Shpigel, 1985; Strand, 1988), sea stars (Gibran, 2002) and several other teleosts (Barreiros and Santos, 1998).

We report the first published record of a juvenile dusky grouper *Epinephelus marginatus* (Lowe, 1834) (about 30 cm of total length, TL) acting as a follower of the goldspotted snake eel *Myrichthys ocellatus* (Lesueur, 1825) in the Arvoredo Biological Marine Reserve (ABMR), Southern Brazil. This marine reserve is the southernmost reef fish sanctuary of the Atlantic. This feeding association was observed only once in January 2001, in a shallow rocky

shore at about 5 m depth, when it was also video recorded (a copy of the video is deposited as voucher at the Universidade do Vale do Itajaí under the registration number LCA/CTTMar 001-2004). The following behaviour has initiated before our observations.

RESULTS AND DISCUSSION

The following association between a juvenile *Epinephelus marginatus* and an adult *Myrichthys ocellatus* was video recorded in January 2001 in a shallow rocky reef shore (maximum depth ~20 m) at 4-5 m depth. Water temperature in north/central coast of Santa Catarina ranges from 15.88-26.82°C (Carvalho *et al.*, 1998). The bottom is mainly overlaid with sparse small sized rocks up to 40 cm wide. The video recorded event is on file (mpg) and can be provided by the corresponding author, upon request.

The following behaviour between the juvenile dusky grouper and the eel was registered only once. A juvenile dusky grouper (follower) of approximately 30 cm TL was already following the gold spotted snake eel (nuclear) when the diver approached the pair. As the eel browsed through the bottom, moving slowly and poking its head into rocky crevices, the grouper placed itself close to the eel body (Fig. 1). The follower position varied from right



Figure 1. - A juvenile *Epinephelus marginatus* following a goldspotted snake eel *Myrichthys ocellatus*. Photo from the video record of Leandro Rangel and Rafael Samagaia. [*Epinephelus marginatus* juvénile suivant un *Myrichthys ocellatus*. Photo d'après un enregistrement vidéo.

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above the eel head to halfway the eel length. In two occasions we were able to observe the grouper striking prey. However, it was not possible to identify them, as the gulping movement was very fast. The following association lasted approximately two minutes. However, as they were already swimming together by the time of our initial sighting, we presume that the foraging association lasted for a longer period of time. No agonistic interaction was observed involving the eel and the follower grouper. The grouper ceased to follow the eel when two other juvenile dusky groupers, of similar size, closed in. This happened at 3–4 m away from where we first detected the association. These groupers came at the same time from adjacent areas visually stimulated by the association, and did not display agonistically. On the contrary, the follower grouper triggered agonistic behaviour as soon as they got nearby. The agonistic interactions displayed by the follower grouper lasted 1–2 minutes. The groupers ceased all interactions and dispersed probably due to the divers closeness. The eel apparently ignored other groupers throughout the following association and agonistic interactions.

The dusky grouper is a popular and economically important species distributed in the East Atlantic Ocean, from the British Isles to the Southern tip of Africa, throughout the Mediterranean Sea, and along the coast of Southern Brazil down to Argentina. It is a protogynous hermaphroditic fish that in Southern Brazilian waters has its first maturation size estimated at 47 cm and change sex when attaining a size of approximately 80 cm (Barreiros, 1998; Andrade *et al.*, 2003). The small size of the observed groupers indicates that they are immature females. *M. ocellatus* is a common snake eel distributed throughout the Western Atlantic. It is often seen moving over the bottom, poking its head into holes in shallow rocky and coral reef shores.

Azorean dusky groupers, while smaller than 90 cm TL, feed mainly on fish and show a secondary preference for crustaceans and octopuses (Barreiros and Santos, 1998). Machado *et al.* (2003) studied juvenile dusky grouper stomach contents and found that crustaceans are the predominant item in their diet, followed by fishes and molluscs. The opportunistic association recorded herein allowed the grouper to have access to small cryptic organisms made available when disturbed by the eel. Clearly, the grouper intended to predate on them during the following interaction. The searching behaviour of the gold spotted snake eel is presumably a feeding campaign for crabs. This is a preferential food item, although some other zoobenthos and a few bony fish might also be captured (Randall, 1967). Although potential food items overlap with that of dusky groupers, we suggest that no negative outcomes happen in this association, as preys attacked by the follower grouper apparently escaped from the eels reach.

The aggressive behaviour observed was apparently related to defence of the advantageous position next to the eel. Simple following action may raise competitive interactions aimed at securing and maintaining a potential food source (Soares and Barreiros, 2003). Dubin (1982) reports on up to five individuals at a time swimming at head level beside eels that were probing into holes. He also pointed out that no agonistic behaviour was recorded (41 associations observed, 36 containing grouper species), either between nuclear and following species or among followers. However, in our single case observation the agonistic behaviour was apparent, and the primary follower seemed not to consider sharing with conspecifics the benefits of following the eel. Soares and Barreiros (2003) observed several species following *Mullus surmuletus* showing intra- and inter-specific agonistic behaviours directed to intruders. The way the aggressive behaviour is displayed is species specific. The agonistic displays shown by the follower dusky grou-

per were analogous to those displayed in other non-following occasions (LCG, unpub. data).

Dusky groupers prefer structurally protected caves, but can be seen unsheltered in the evening, when day light starts to decrease (LCG, pers. obs.). This behaviour is common among reef predators, especially in groupers, and is related to the increasing efficiency of predation in the twilight. Otherwise, dusky groupers are known to ambush hunting (Barreiros, 1998), an apparent energy saver tactic. Thus, swimming around the reef in close proximity to an eel would have energy costs. In fact, Diamant and Shpigel (1985) found strong evidences that following an eel increases successful strikes. This was practically verified by a higher percentage of chewing behaviour after each strike when groupers were associated to a nuclear species. Unfortunately it was not possible for us to evaluate this association in such a detailed way, but we are convinced that the association between *E. marginatus* and *M. ocellatus* was meaningful, leading the follower grouper to actively defend its position.

We believe that agonistic episodes among juvenile groupers are part of their way of experiencing other groupers and starting to show territoriality. Agonistic behaviour among juvenile dusky groupers is common (LCG, pers. obs.), and certainly deserves a quantitative and spatial approach as a mean to further investigate these behavioural interactions. Despite hundreds of SCUBA dives done by our research team in the study area, no other following association between the dusky grouper and other animals was recorded. Thus, we were initially encouraged to define this episode as a rare association. However, the observation made on this paper was occasional and all of the research effort done was not directed to behavioural observations. We are inclined to suspect that fish interspecific interactions in Santa Catarina state rocky reefs are more diverse than previously thought.

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